III. "On the Difference in the Properties of Hot-Rolled and Cold-Rolled Malleable Iron, as regards the power of receiving and retaining Induced Magnetism of Subpermanent Character." By GEORGE BIDDELL AIRY, Esq., F.R.S., Astronomer Royal. Received April 22, 1862.

(Abstract.)

The author states that he had been desirous of examining whether differences in the degree of change of subpermanent magnetism, such as are exhibited by different iron ships, might not depend on the temperature at which the iron is rolled in the last process of its manufacture. By the good offices of Mr. Fairbairn he had received gratuitously from Richard Smith, Esq., Superintendent of Lord Dudley's Iron Works at the Round Oak Works near Dudley, twenty-four plates of iron, each 16 inches long, 4 inches broad, and $\frac{1}{4}$ inch thick; twelve of which, after having been manufactured with the others in the usual way, had been passed through rollers when quite cold. Each set of twelve was divided into two parcels of six each, one parcel being cut with the length of the bars in the length of extension of the fibres of the iron, the other being cut with the length of the bars transverse to the length of extension.

For experimenting on these, a large wooden frame was prepared, capable of receiving the 24 bars at once, either on a plane transverse to the direction of dip at Greenwich, or on a plane including the direction of dip. In some experiments, these planes were covered with flag-stones, and the bars were laid upon the flag-stones; in others, the bars were laid immediately upon the wood. While there lying, they were struck with iron or wooden hammers of different sizes. The bars of the different classes were systematically intermingled, in such a way that no tendency of the arm to give blows of a different force or kind in special parts of the series could produce a class-error in the result. For examination of the amount of polar magnetism in each bar, it was placed at a definite distance (5 inches) below a prismatic compass, which was used to observe the apparent azimuth of a fixed mark; the bar was then reversed in length, and the observation was repeated in that state.

The number of experiments was 21. They were varied by differ-

ence in the succession of positions of the bars, difference of time allowed for rest, difference in the violence of the blows, &c.

The principal results appear to be the following :—

1. The greatest amount of magnetism which a bar can receive, appears to be such as will produce (on the average of bars) a compass-deviation of about 11°, the bar being 5 inches below the compass. It was indifferent whether the bars rested on stone or on wood, or whether they were struck with iron or with wood, the bars lying on the dip plane while struck.

2. When the bars, thus charged, lay on the plane transverse to the dip, they lost about one-fifth of their magnetism in one or two days, and lost very little afterwards.

3. When the charge of magnetism is smaller than the maximum, the diminution in a day or two is nearly in the same proportion as for the maximum.

4. The effect of violence on the bars, when lying on the plane transverse to the dip, is not in all cases to destroy the magnetism completely, sometimes it increases the magnetism.

5. The Cold-Rolled Iron receives (under similar violence) or parts with (under similar violence) a greater amount of magnetism than the Hot-Rolled Iron, in the proportion of 6 to 5.

6. There is some reason to think that the Hot-Rolled Iron has a greater tendency to retain its primitive magnetism than the Cold-Rolled Iron has.

7. There is some reason to think that, when lying tranquil, the Hot-Rolled Iron loses a larger portion of its magnetism than the Cold-Rolled Iron loses in the same time.

IV. "On the Analytical Theory of the Conic." By Arthur Cayley, Esq., F.R.S. Received May 8, 1862.

(Abstract.)

The decomposition into its linear factors of a decomposable quadric function cannot be effected in a symmetrical manner otherwise than by formulæ containing supernumerary arbitrary quantities; thus, for a binary quadric (which of course is always decomposable) we have

$$(a, b, c \between x, y)^2 = \frac{1}{(a, b, c \between x', y')^2} \text{ Prod. } \{(a, b, c \between x, y \between x', y') \pm \sqrt{ac-b^2}(xy'-x'y)\};$$